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DeBates et al.

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(54) **MOBILE ELECTRONIC DEVICE COMPATIBLE IMMERSIVE HEADWEAR FOR PROVIDING BOTH AUGMENTED REALITY AND VIRTUAL REALITY EXPERIENCES**

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G02B 27/01 (2006.01)

(52) **U.S. Cl.**

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(58) **Field of Classification Search**

None

See application file for complete search history.

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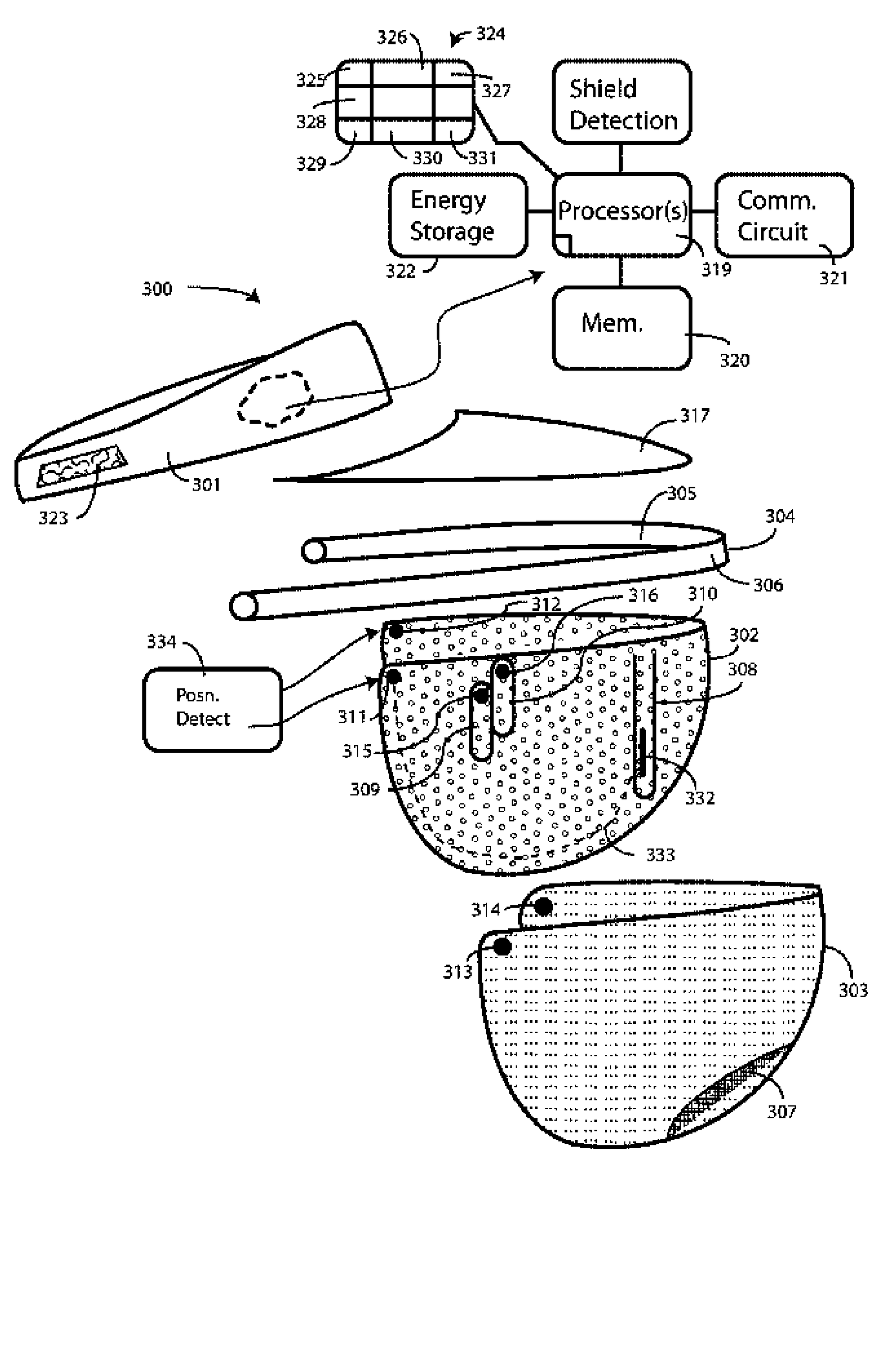
(57) **ABSTRACT**

An apparatus can include headwear having a head receiver that is pivotally coupled to a first shield. A second shield can be attached to the headwear exterior to the first shield. The second shield can include a holographic optical element. An electronic device can be coupled to, or alternatively integrated with, the first shield. One or more processors of the electronic device can determined whether the first shield is in a first position relative to the head receiver or a second, angularly displaced position. Where the first shield is in the first position, the one or more processors can operate the electronic device in a virtual reality mode of operation. Where the first shield is in the second, angularly displaced position, the one or more processors can operate the electronic device in an augmented reality mode of operation.

20 Claims, 8 Drawing Sheets



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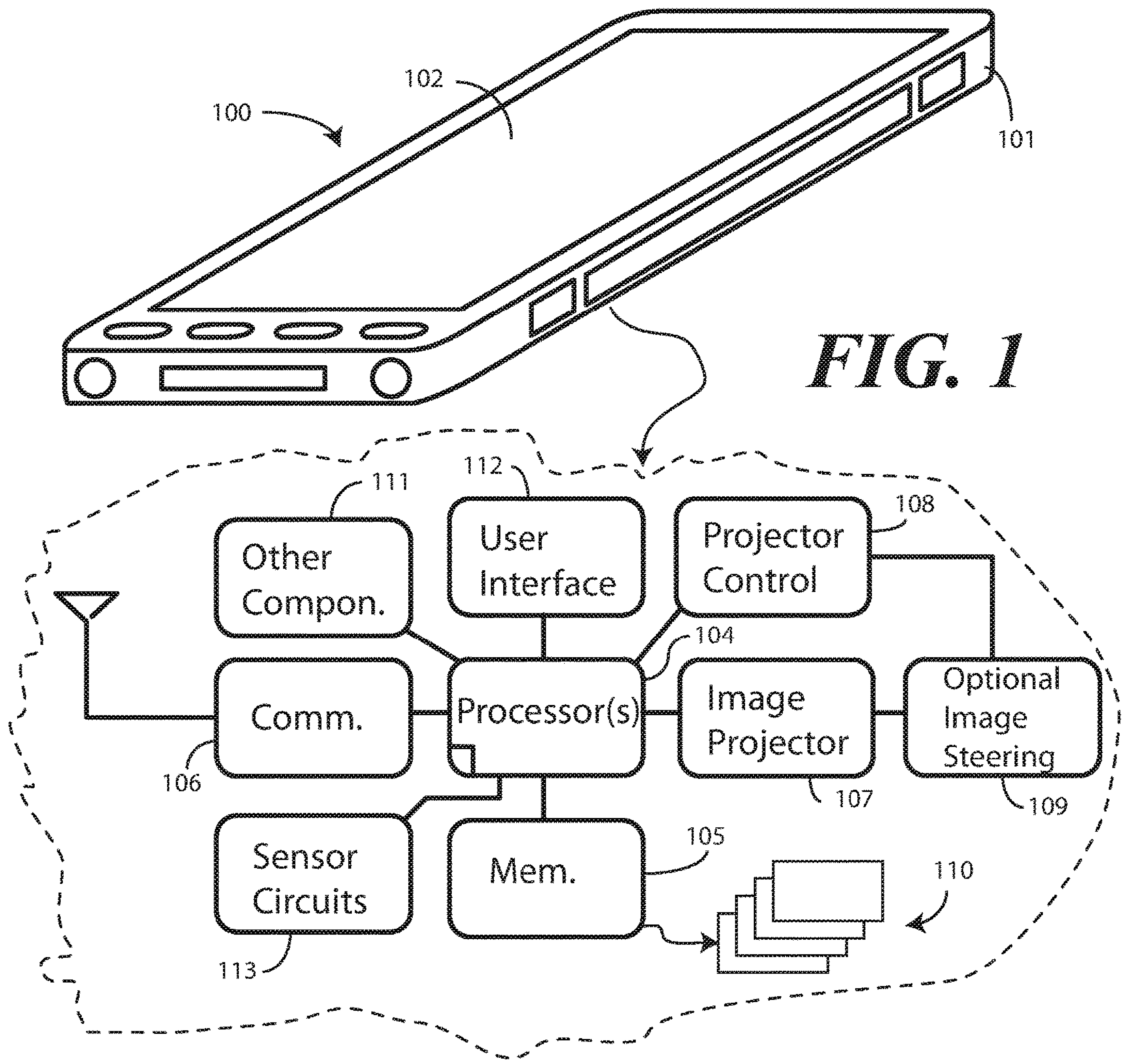
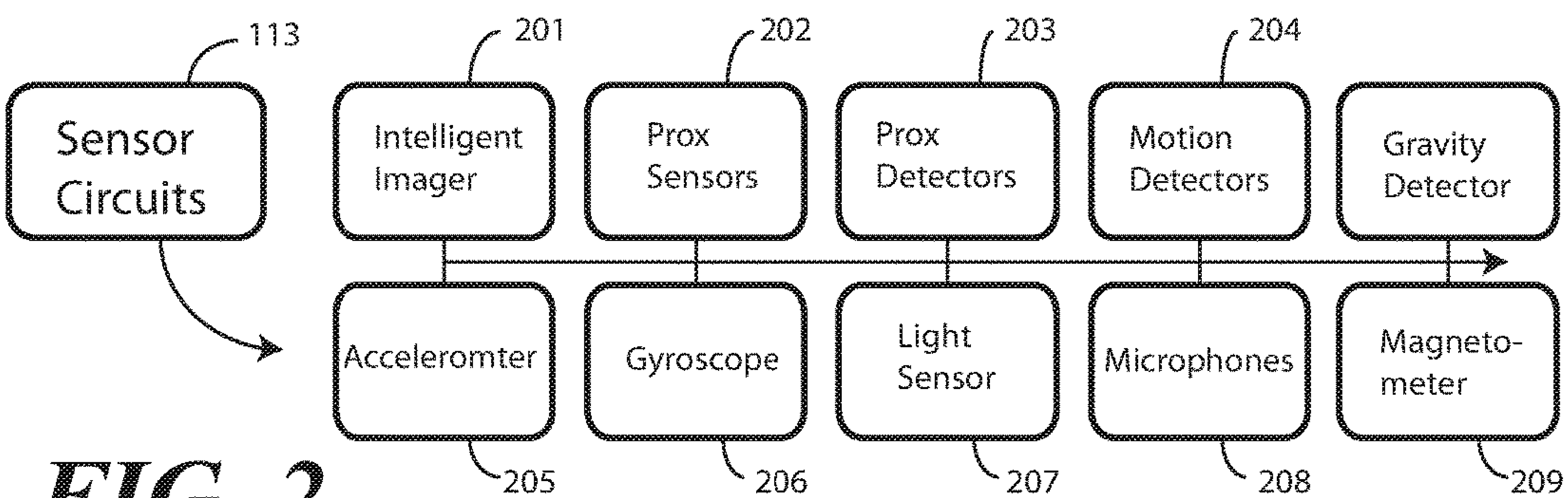


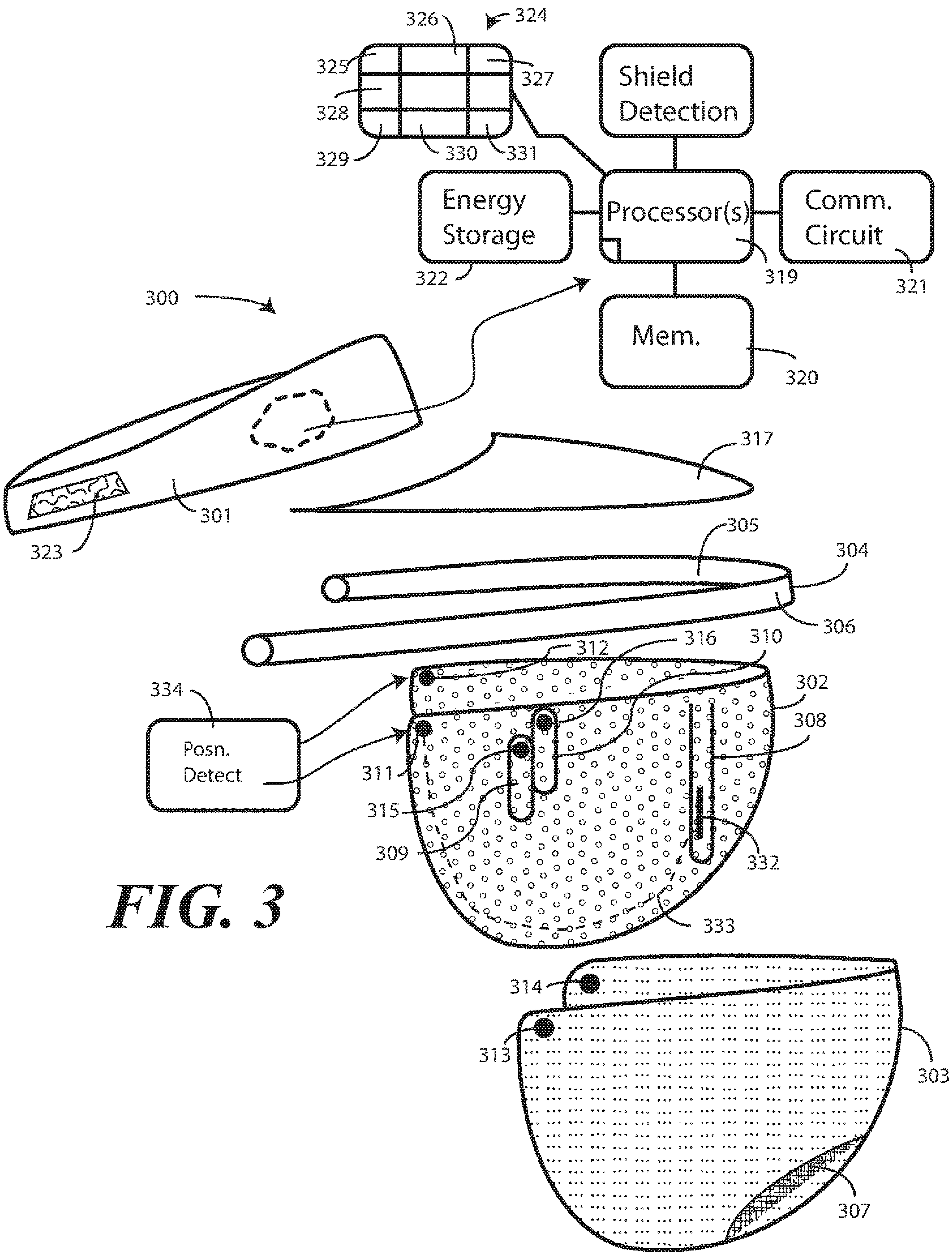
100
102
101
111
112
108
Other Compon.
User Interface
Projector Control
104
Comm.
Processor(s)
Image Projector
Optional Image Steering
106
107
109
Sensor Circuits
Mem.
105
110
113

FIG. 1



113
201
202
203
204
Sensor Circuits
Intelligent Imager
Prox Sensors
Prox Detectors
Motion Detectors
Gravity Detector
Acceleromter
Gyroscope
Light Sensor
Microphones
Magneto-meter
205
206
207
208
209

FIG. 2



324
326
325
327
328
329
330
331
Shield Detection
Energy Storage
Processor(s)
Comm. Circuit
322
319
321
Mem.
320
300
317
301
323
305
304
306
312
316
310
334
302
308
Posn. Detect
311
315
309
332
333
314
313
303
307

FIG. 3

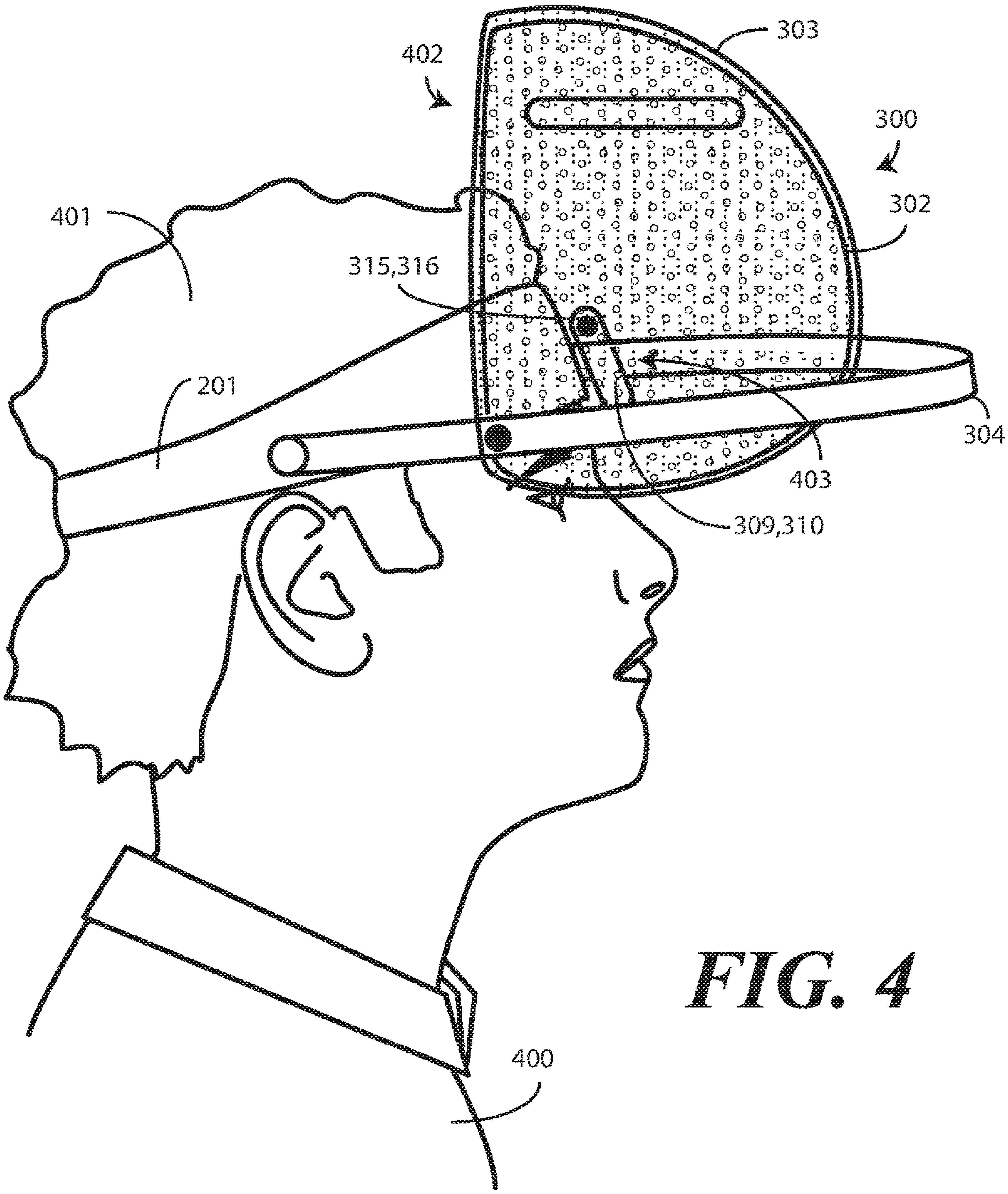


FIG. 4

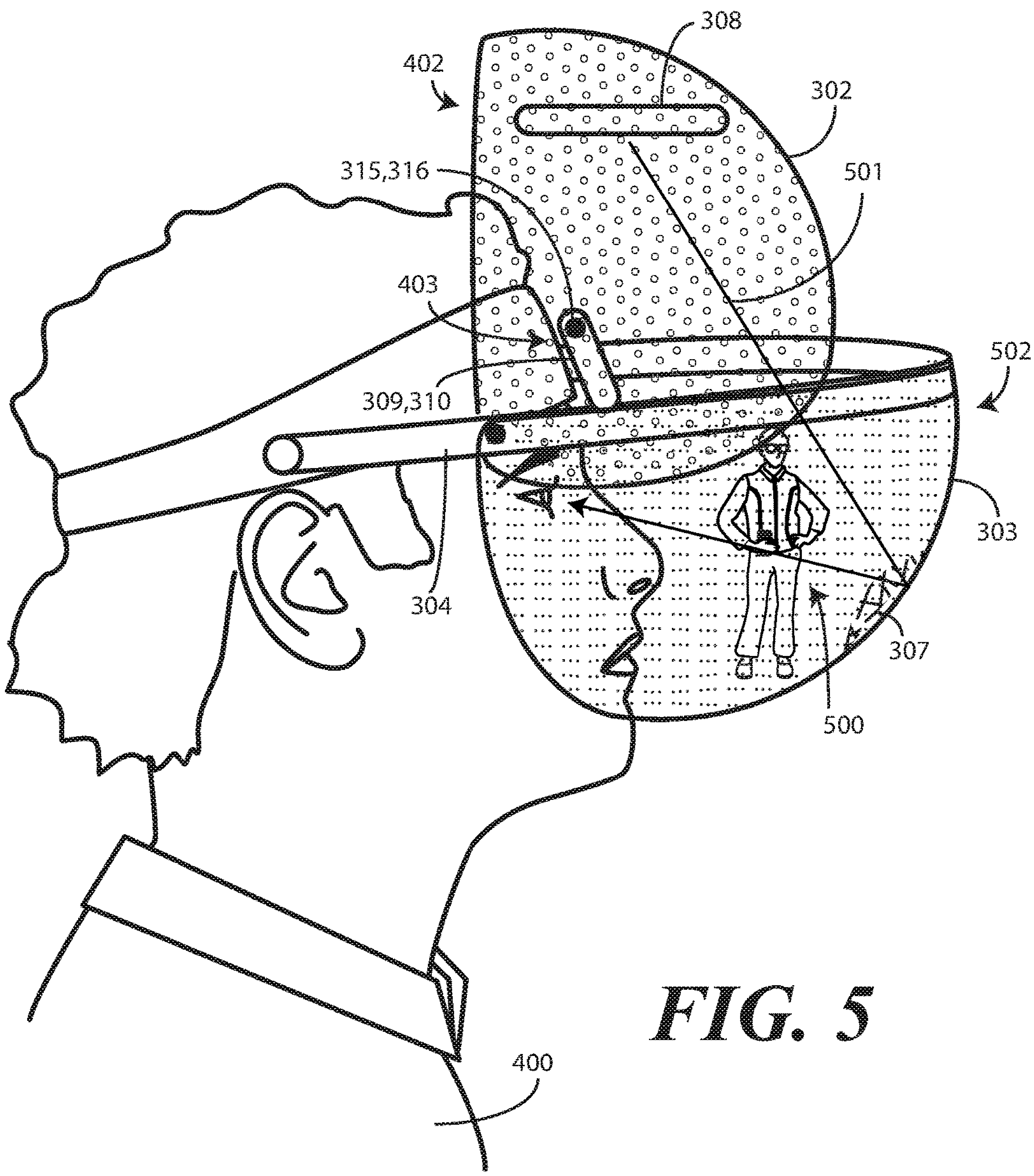


FIG. 5

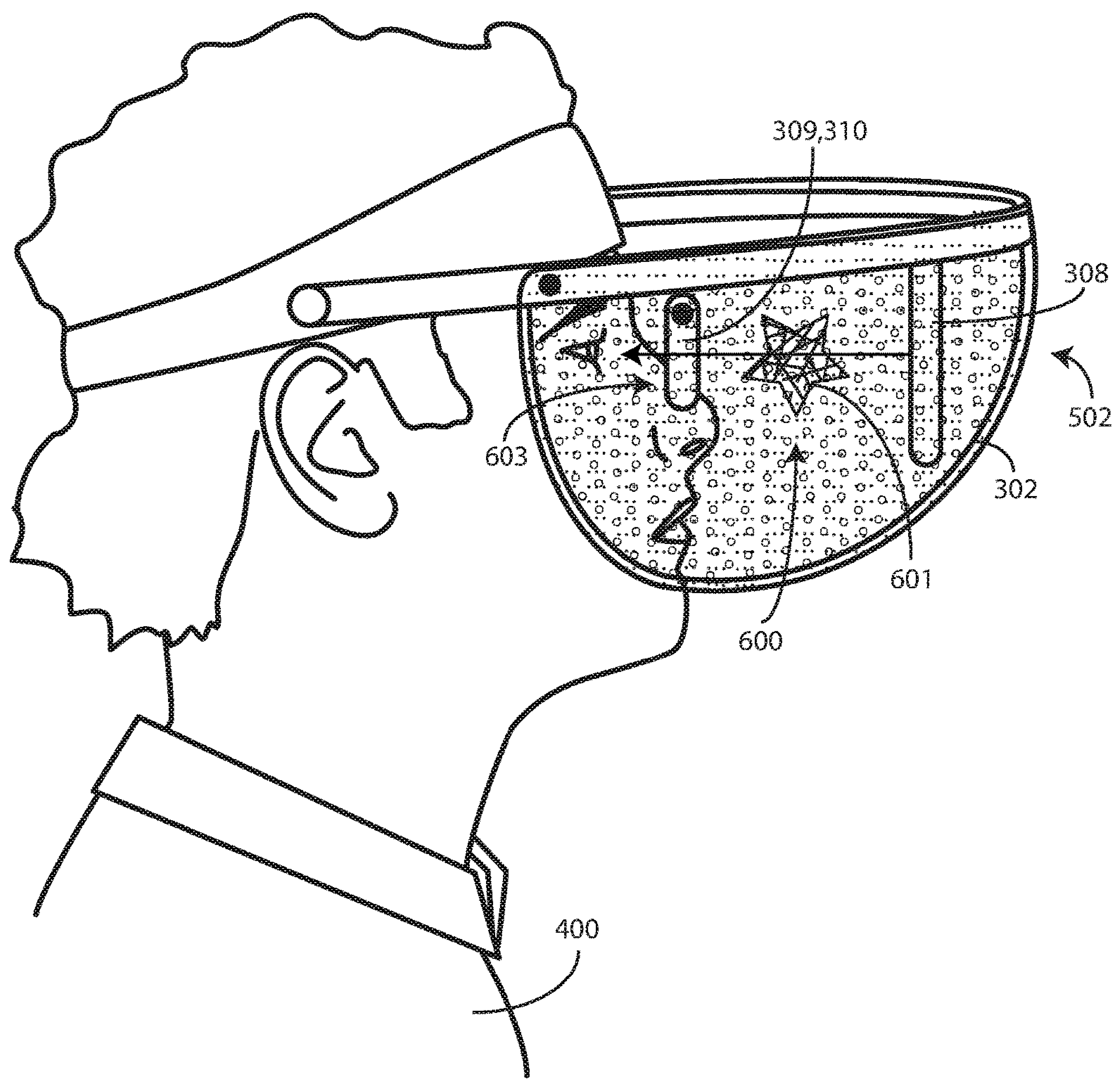


FIG. 6

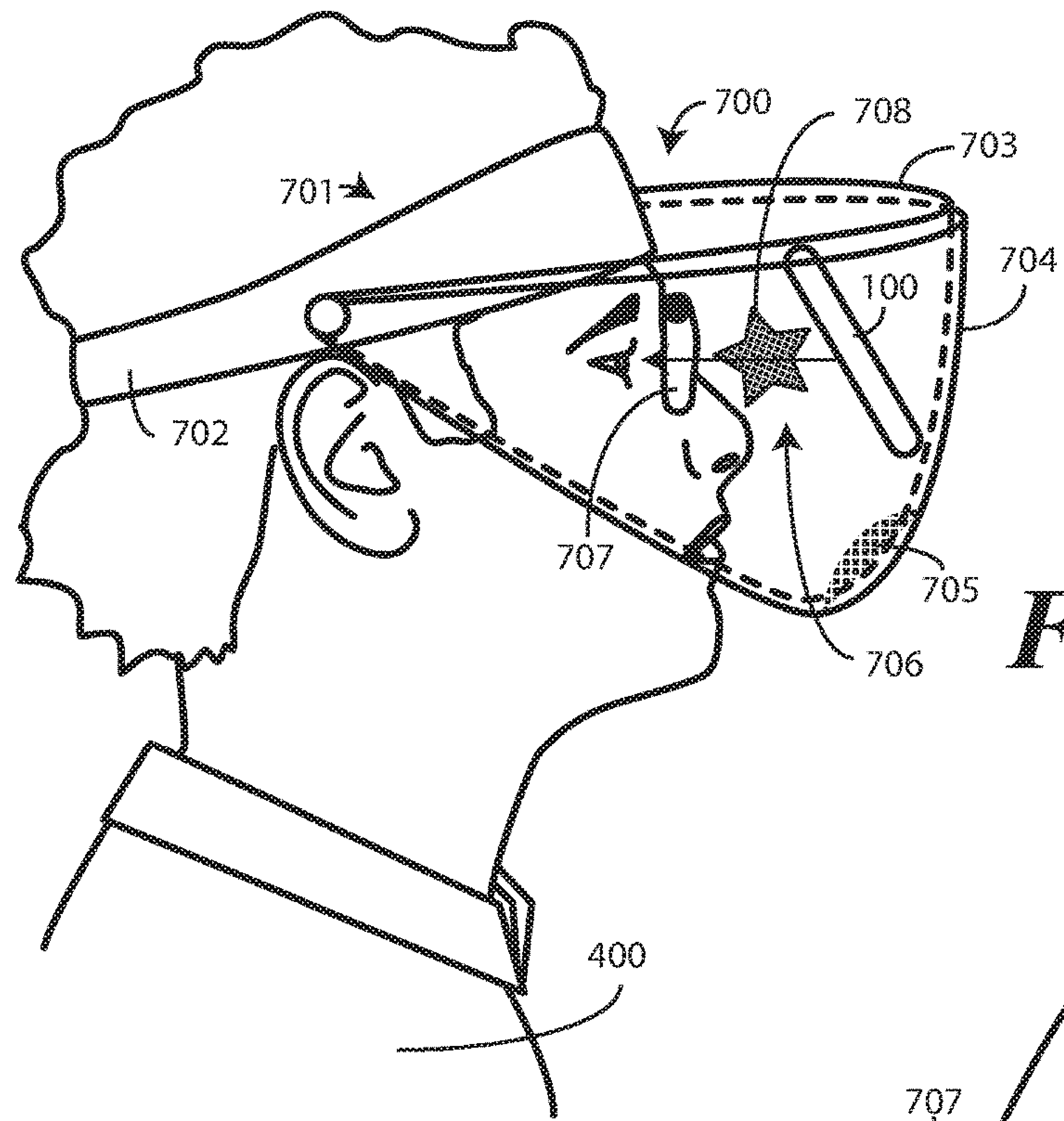

700
708
703
701
704
100
702
707
705
706
400

FIG. 7

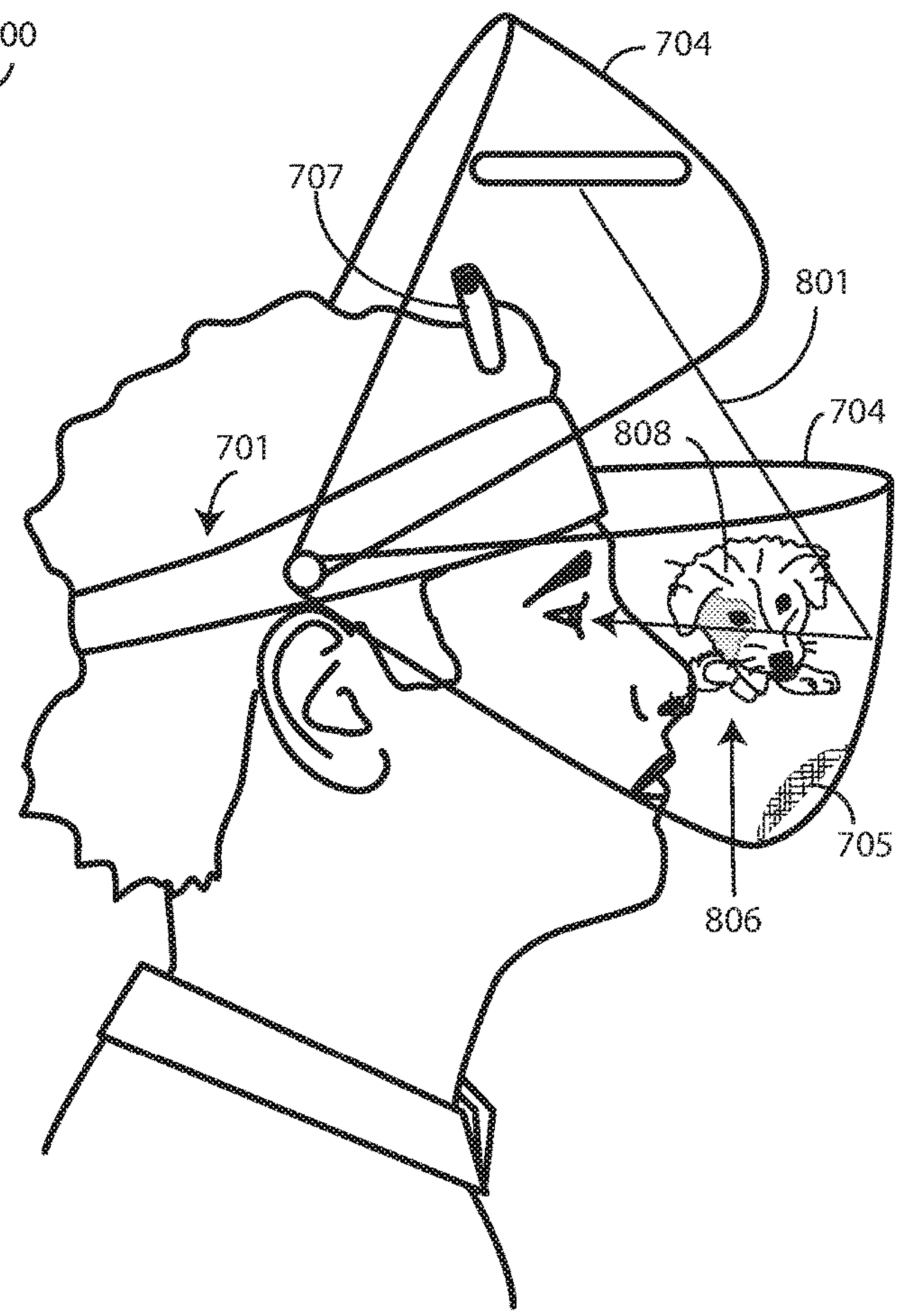

704
707
801
704
808
701
705
806

FIG. 8

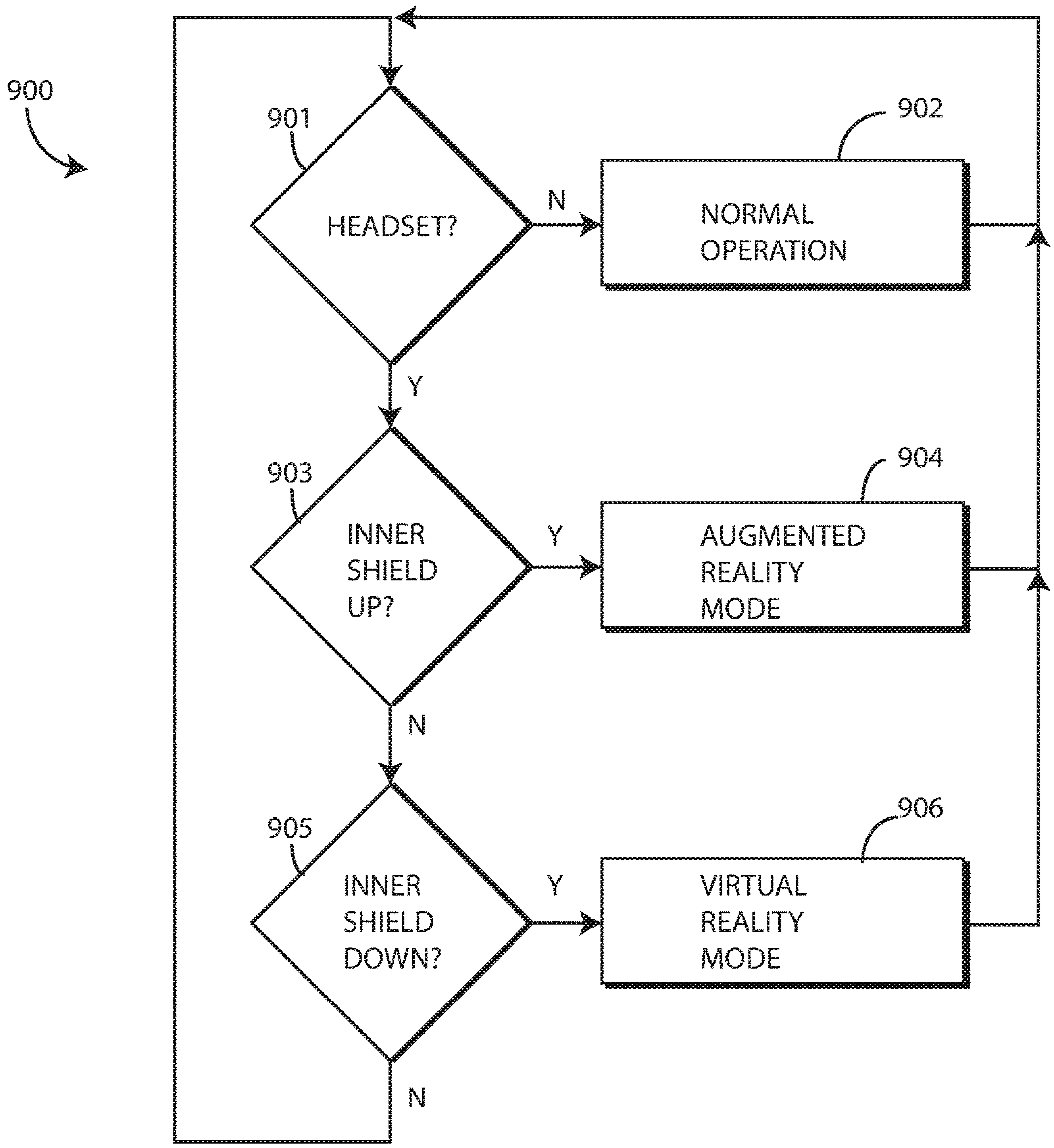

900
901
HEADSET?
N
902
NORMAL OPERATION
Y
903
INNER SHIELD UP?
Y
904
AUGMENTED REALITY MODE
N
905
INNER SHIELD DOWN?
Y
906
VIRTUAL REALITY MODE
N

FIG. 9

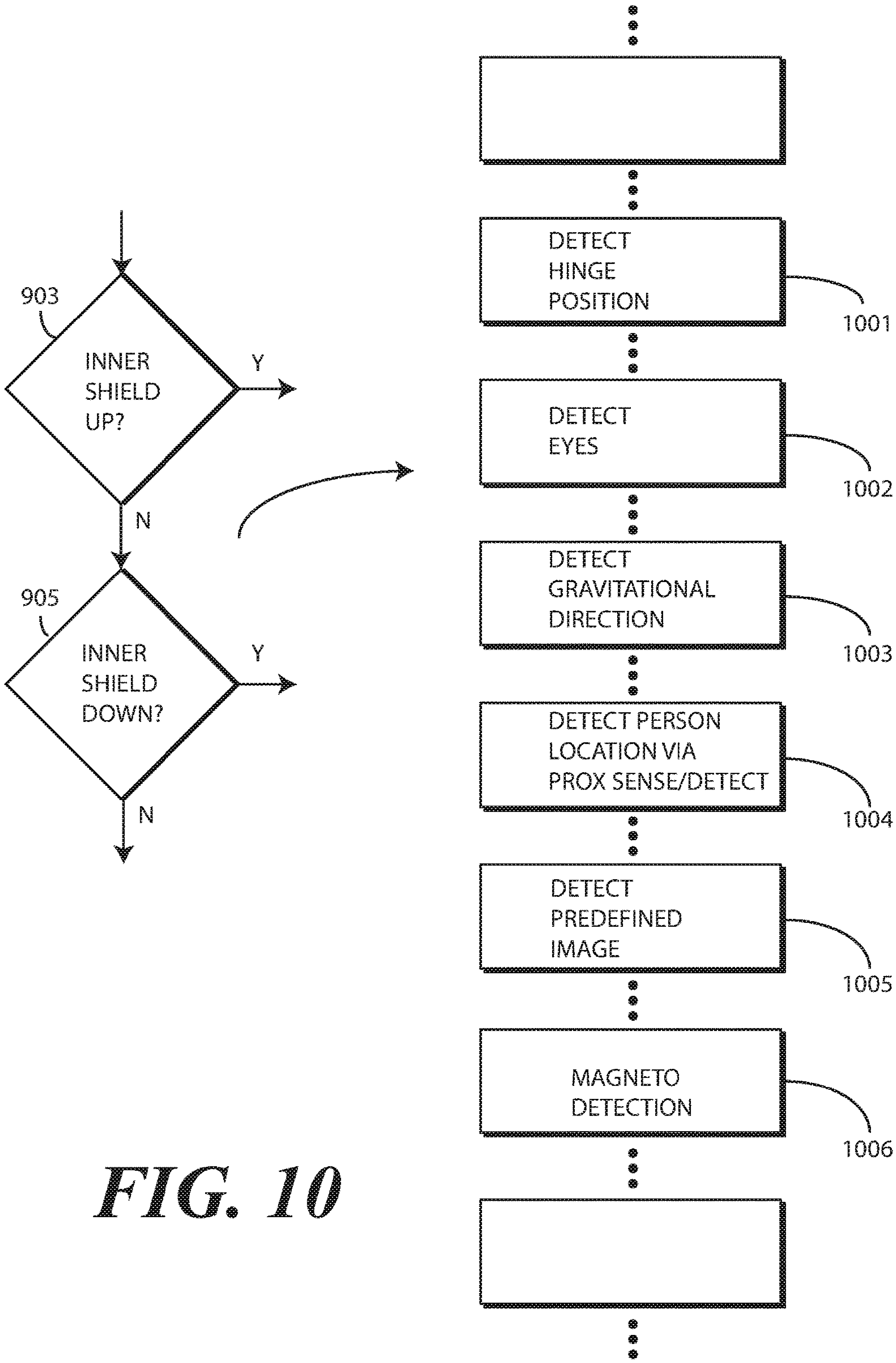

903
INNER SHIELD UP?
Y
N
905
INNER SHIELD DOWN?
Y
N
DETECT HINGE POSITION
1001
DETECT EYES
1002
DETECT GRAVITATIONAL DIRECTION
1003
DETECT PERSON LOCATION VIA PROX SENSE/DETECT
1004
DETECT PREDEFINED IMAGE
1005
MAGNETO DETECTION
1006

FIG. 10

MOBILE ELECTRONIC DEVICE COMPATIBLE IMMERSIVE HEADWEAR FOR PROVIDING BOTH AUGMENTED REALITY AND VIRTUAL REALITY EXPERIENCES

BACKGROUND

Technical Field

This disclosure relates generally to electronic devices, and more particularly to devices operable in multiple modes of operation.

Background Art

Immersive head mounted displays have been developed to provide alternative reality experiences to a user. These alternative reality experiences occur when electronically rendered images are delivered to a user's eyes in such a way that they are perceived as real objects. Conventional head mounted displays can provide, for example, a virtual reality experience to a user for gaming, simulation training, or other purposes. In virtual reality systems, images are presented to a user's eyes solely from an electronic device without the addition of light or images from the physical environment. Other conventional head mounted displays can provide a different experience, namely, an augmented reality experience to a user. In augmented reality systems, electronically generated images are presented to a user as an augmentation to light or images from the physical environment.

While such conventional head mounted displays can perform well for their given technologies, they do not support other technologies. Thus, a virtual reality head mounted display cannot provide a virtual reality experience and vice versa. It would be desirable to have an improved device capable of providing both augmented reality and virtual reality experiences to a user.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying figures, where like reference numerals refer to identical or functionally similar elements throughout the separate views and which together with the detailed description below are incorporated in and form part of the specification, serve to further illustrate various embodiments and to explain various principles and advantages all in accordance with the present disclosure.

FIG. **1** illustrates one explanatory electronic device in accordance with one or more embodiments of the disclosure.

FIG. **2** illustrates one or more sensors operable, alone or in combination, with an electronic device in accordance with one or more embodiments of the disclosure.

FIG. **3** illustrates a system view of one explanatory headwear configured in accordance with one or more embodiments of the disclosure.

FIG. **4** illustrates a user wearing an explanatory headwear in accordance with one or more embodiments of the disclosure.

FIG. **5** illustrates an explanatory headwear configured in accordance with one or more embodiments of the disclosure operating in an augmented reality mode of operation.

FIG. **6** illustrates an explanatory headwear configured in accordance with one or more embodiments of the disclosure operating in a virtual reality mode of operation.

FIG. **7** illustrates an alternate headwear configured in accordance with one or more embodiments of the disclosure operating in a virtual reality mode of operation.

FIG. **8** illustrates an alternate headwear configured in accordance with one or more embodiments of the disclosure operating in an augmented reality mode of operation.

FIG. **9** illustrates one explanatory method in accordance with one or more embodiments of the disclosure.

FIG. **10** illustrates another explanatory method in accordance with one or more embodiments of the disclosure.

Skilled artisans will appreciate that elements in the figures are illustrated for simplicity and clarity and have not necessarily been drawn to scale. For example, the dimensions of some of the elements in the figures may be exaggerated relative to other elements to help to improve understanding of embodiments of the present disclosure.

DETAILED DESCRIPTION OF THE DRAWINGS

Before describing in detail embodiments that are in accordance with the present disclosure, it should be observed that the embodiments reside primarily in combinations of method steps and apparatus components related to providing, with a single, portable electronic device, both augmented reality and virtual reality experiences to a user when the electronic device is coupled to a headwear in accordance with one or more embodiments of the disclosure. Any process descriptions or blocks in flow charts should be understood as representing modules, segments, or portions of code which include one or more executable instructions for implementing specific logical functions or steps in the process. Alternate implementations are included, and it will be clear that functions may be executed out of order from that shown or discussed, including substantially concurrently or in reverse order, depending on the functionality involved. Accordingly, the apparatus components and method steps have been represented where appropriate by conventional symbols in the drawings, showing only those specific details that are pertinent to understanding the embodiments of the present disclosure so as not to obscure the disclosure with details that will be readily apparent to those of ordinary skill in the art having the benefit of the description herein.

Embodiments of the disclosure do not recite the implementation of any commonplace business method aimed at processing business information, nor do they apply a known business process to the particular technological environment of the Internet. Moreover, embodiments of the disclosure do not create or alter contractual relations using generic computer functions and conventional network operations. Quite to the contrary, embodiments of the disclosure employ methods that, when applied to electronic device and/or user interface technology, improve the functioning of the electronic device itself by and improving the overall user experience to overcome problems specifically arising in the realm of the technology associated with electronic device user interaction.

It will be appreciated that embodiments of the disclosure described herein may be comprised of one or more conventional processors and unique stored program instructions that control the one or more processors to implement, in conjunction with certain non-processor circuits, some, most, or all of the functions of providing either virtual reality experiences or augmented reality experiences to a user when coupled to headwear configured in accordance with embodiments of the disclosure as described herein. The non-processor circuits may include, but are not limited to, a radio receiver, a radio transmitter, signal drivers, clock circuits, power source circuits, and user input devices. As such, these functions may be interpreted as steps of a method to perform the delivery of either augmented reality experiences or virtual reality experiences from a single device when coupled to headwear configured in accordance with embodiments of the disclosure. Alternatively, some or all functions could be implemented by a state machine that has no stored program instructions, or in one or more application specific integrated circuits (ASICs), in which each function or some combinations of certain of the functions are implemented as custom logic. Of course, a combination of the two approaches could be used. Thus, methods and means for these functions have been described herein. Further, it is expected that one of ordinary skill, notwithstanding possibly significant effort and many design choices motivated by, for example, available time, current technology, and economic considerations, when guided by the concepts and principles disclosed herein will be readily capable of generating such software instructions and programs and ICs with minimal experimentation.

Embodiments of the disclosure are now described in detail. Referring to the drawings, like numbers indicate like parts throughout the views. As used in the description herein and throughout the claims, the following terms take the meanings explicitly associated herein, unless the context clearly dictates otherwise: the meaning of "a," "an," and "the" includes plural reference, the meaning of "in" includes "in" and "on." Relational terms such as first and second, top and bottom, and the like may be used solely to distinguish one entity or action from another entity or action without necessarily requiring or implying any actual such relationship or order between such entities or actions. As used herein, components may be "operatively coupled" when information can be sent between such components, even though there may be one or more intermediate or intervening components between, or along the connection path. The terms "substantially" and "about" are used to refer to dimensions, orientations, or alignments inclusive of manufacturing tolerances. Thus, a "substantially orthogonal" angle with a manufacturing tolerance of plus or minus two degrees would include all angles between 88 and 92, inclusive. Also, reference designators shown herein in parenthesis indicate components shown in a figure other than the one in discussion. For example, talking about a device (**10**) while discussing figure A would refer to an element, **10**, shown in figure other than figure A.

Embodiments of the disclosure provide headwear configured to deliver either an augmented reality experience or a virtual reality experience to a user from a single device. In one embodiment, the headwear couples to couple to a portable electronic device, which serves as the single device providing the augmented reality or virtual reality experiences to the user. In other embodiments, the headwear includes its own integrated display, sensors, and processors to provide the augmented reality or virtual reality experiences to the user. In one or more embodiments, the headwear comprises a head receiver. A user inserts their head into the head receiver to mount the headwear on their head.

In one or more embodiments, the headwear comprises a first shield and a second shield. In one embodiment, the first shield is pivotally coupled to the head receiver while the second shield is stationary. In another embodiment, the first shield and the second shield are both pivotally coupled to the head receiver. In yet another embodiment, one or both of the first shield or the second shield are detachable from the head receiver and are capable of being attached to the head receiver at different geometric orientations relative to the head receiver. In one or more embodiments, the first shield is disposed interior to the second shield.

In one or more embodiments, the first shield is opaque. In one or more embodiments, the second shield is pellucid or translucent and includes a holographic optical element. In one or more embodiments, the first shield comprises a receiver into which the portable electronic device can be mounted. Accordingly, the electronic device can mechanically couple to the first shield when inserted into the receiver.

In one or more embodiments, the electronic device comprises one or more processors. The one or more processors can be operable with one or more sensors, which can include gravity detectors, proximity sensors, optical sensors, motion sensors, geolocational sensors, or other sensors. Working with the sensors, in one or more embodiments the one or more processors can determine whether the first shield is in a first position relative to the head receiver or, alternatively, whether the first shield is disposed in a second position relative to the head receiver that is angularly displaced from the first position.

In one or more embodiments, when the first shield is in the first position, the one or more processors operate the electronic device in a virtual reality mode of operation. For example, when the first shield is in the first position, the one or more processors may deliver images from the display to the user's eyes through one or more lenses to provide three-dimensional and other virtual reality effects to the user.

However, when the first shield is in the second, angularly displaced position, in one or more embodiments the one or more processors operate the electronic device in an augmented reality mode of operation. For example, in one embodiment the electronic device comprises a projector. The one or more processors can cause the projector to reflect images off of the holographic optical element to make augmented images appear before the user's eyes in the user's ordinary field of view.

In one or more embodiments, the first shield comprises one or more optical lenses. The optical lenses can be coupled to the first shield so as to pivot from a first orientation to a second orientation when the first shield pivots from the first position to the second, angularly displaced position. When the optical lenses pivot to the second orientation, they define an unobstructed optical line of sight between the electronic receiver and the holographic optical element so that images can be delivered to the holographic optical element without passing through the optical lenses. By contrast, when the firsts shield pivots or is otherwise moved to the first position, the optical lenses fall within the optical line of sight between the electronic receiver and the user's eyes. This allows images from the display to pass through the optical lenses to provide a virtual reality experience to the user.

Turning now to FIG. **1**, illustrated therein is one explanatory electronic device **100** configured in accordance with one or more embodiments of the disclosure. The electronic device **100** of FIG. **1** is shown as a portable electronic device. As will be described in more detail below, in one or more embodiments the electronic device **100** is selectively attachable and detachable from headwear to provide either a virtual reality experience or an augmented reality experience to a user depending upon the physical configuration of the headgear. However, it should be noted that the electronic device **100** could be fully integrated into the headwear in other applications such that the headwear has integrated processors **104**, display **102**, and other components. For simplicity, the former embodiment will be described as an illustrative example. However, for each embodiment described, it should be noted that rather than attaching the electronic device **100** to a receiver of headwear, the components of the electronic device **100** could be integrated into the headwear instead.

The explanatory electronic device **100** of FIG. **1** includes a housing **101**. The housing **101** can include one or more housing portions, such as a first housing portion and a second housing portion. In this illustrative embodiment, the first housing portion **103** is disposed about the periphery of the display **102**.

A block diagram schematic of the electronic device **100** is also shown in FIG. **1**. In one embodiment, the electronic device **100** includes one or more processors **104**. The one or more processors **104** are operable with the display **102** and other components of the electronic device **100**. The one or more processors **104** can include a microprocessor, a group of processing components, one or more ASICs, programmable logic, or other type of processing device. The one or more processors **104** can be operable with the various components of the electronic device **100**. The one or more processors **104** can be configured to process and execute executable software code to perform the various functions of the electronic device **100**.

A storage device, such as memory **105**, can optionally store the executable software code used by the one or more processors **104** during operation. The memory **105** may include either or both static and dynamic memory components, may be used for storing both embedded code and user data. The software code can embody program instructions and methods to operate the various functions of the electronic device **100**, and also to execute software or firmware applications and modules. The one or more processors **104** can execute this software or firmware, and/or interact with modules, to provide device functionality.

In this illustrative embodiment, the electronic device **100** also includes an optional communication circuit **106** that can be configured for wired or wireless communication with one or more other devices or networks. The networks can include a wide area network, a local area network, and/or personal area network. Examples of wide area networks include GSM, CDMA, W-CDMA, CDMA-2000, iDEN, TDMA, 2.5 Generation 3GPP GSM networks, 3rd Generation 3GPP WCDMA networks, 3GPP Long Term Evolution (LTE) networks, and 3GPP2 CDMA communication networks, UMTS networks, E-UTRA networks, GPRS networks, iDEN networks, and other networks.

The communication circuit **106** may also utilize wireless technology for communication, such as, but are not limited to, peer-to-peer or ad hoc communications such as HomeRF, Bluetooth and IEEE 802.11 (a, b, g or n); and other forms of wireless communication such as infrared technology. The communication circuit **106** can include wireless communication circuitry, one of a receiver, a transmitter, or transceiver, and one or more antennas.

In one or more embodiments, the electronic device **100** also includes a projector **107**. In the illustrative embodiment of FIG. **1**, the housing **101** supports the projector **107**. As will be described in more detail below, where the projector **107** is included, in one or more embodiments the projector **107** is configured to deliver images to a holographic optical element when the electronic device **100** is operating in an augmented reality mode of operation.

In one embodiment, the projector **107** is a modulated light projector operable to project modulated light images along a surface or holographic optical element. In another embodiment, the projector **107** is a thin micro projector. In another embodiment, the projector **107** can comprise a laser projector display module. Other types of projectors will be obvious to those of ordinary skill in the art having the benefit of this disclosure.

In one or more embodiments, the projector **107** can include a lens and a spatial light modulator **109** configured to manipulate light to produce images. The projector **107** can include a light source, such as a single white light emitting diode, multiple separate color light emitting diodes, or multiple separate color laser diodes that deliver visible light to the spatial light modulator through a color combiner. A projector control manager **108** can be coupled to the spatial light modulator **109** to drive the spatial light modulator **109** to modulate the light to produce images. The spatial light modulator **109** can be optically coupled (e.g., by free space propagation) to the lens and/or a beam steerer. Where used, a beam steerer serves to steer a spatially modulated light beam emanating from the spatial light modulator **109** through the lens to create images.

The one or more processors **104** can be responsible for performing the primary functions of the electronic device **100**. For example, in one embodiment the one or more processors **104** comprise one or more circuits operable with one or more user interface devices, which can include the display **102**, to present presentation information to a user. The executable software code used by the one or more processors **104** can be configured as one or more modules **110** that are operable with the one or more processors **104**. Such modules **110** can store instructions, control algorithms, and so forth. While these modules **110** are shown as software stored in the memory **105**, they can be hardware components or firmware components integrated into the one or more processors **104** as well.

Other components **111** can be included with the electronic device **100**. The other components **111** can be operable with the one or more processors **104** and can include input and output components associated with a user interface **112**, such as power inputs and outputs, audio inputs and outputs, and/or mechanical inputs and outputs. The other components **111** can include output components such as video, audio, and/or mechanical outputs. For example, the output components may include a video output component or auxiliary devices including a cathode ray tube, liquid crystal display, plasma display, incandescent light, fluorescent light, front or rear projection display, and light emitting diode indicator. Other examples of output components include audio output components such as a loudspeaker disposed behind a speaker port or other alarms and/or buzzers and/or a mechanical output component such as vibrating or motion-based mechanisms. Still other components will be obvious to those of ordinary skill in the art having the benefit of this disclosure.

One or more sensor circuits **113** are operable with the one or more processors **104** in one or more embodiments. These sensor circuits **113** can be used to detect, for example, whether the electronic device **100** is coupled to a receiver of a shield of headwear, and whether the shield is in a first position relative to the headwear or in a second, angularly displaced position from the first position relative to the headwear. Generally speaking, the one or more sensor circuits **113** can include sensors configured to sense or determine physical parameters indicative of conditions in an environment about the electronic device **100**.

Illustrating by example, the physical sensors can include devices for determining information such as motion, bearing, location, travel mode, acceleration, orientation, proximity to people, places, and other objects, lighting, capturing images, and so forth. The one or more sensor circuits **113** can include various combinations of microphones, location detectors, motion sensors, physical parameter sensors, temperature sensors, barometers, proximity sensor components, proximity detector components, wellness sensors, touch sensors, cameras, audio capture devices, and so forth. Many examples of sensor circuits **113** are described below with reference to FIG. **2**. Others will be obvious to those of ordinary skill in the art having the benefit of this disclosure.

It is to be understood that FIG. **1** is provided for illustrative purposes only and for illustrating components of one electronic device **100** in accordance with embodiments of the disclosure, and is not intended to be a complete schematic diagram of the various components required for an electronic device. Therefore, other electronic devices in accordance with embodiments of the disclosure may include various other components not shown in FIG. **1**, or may include a combination of two or more components or a division of a particular component into two or more separate components, and still be within the scope of the present disclosure.

Turning now to FIG. **2**, illustrated therein are examples of various sensor circuits **113** that can be operable—alone or in combination—with the one or more processors (**104**) of the electronic device (**100**) in accordance with one or more embodiments of the disclosure. It should be noted that the sensor circuits **113** shown in FIG. **2** are not comprehensive, as others will be obvious to those of ordinary skill in the art having the benefit of this disclosure. Additionally, it should be noted that the various sensor circuits **113** shown in FIG. **2** could be used alone or in combination. Accordingly, many electronic devices will employ only subsets of the sensor circuits **113** shown in FIG. **2**, with the particular subset defined by device application.

An intelligent imager **201** can be configured to capture an image of environments about an electronic device and determine whether the object matches predetermined criteria. For example, the intelligent imager **201** operate as an identification module configured with optical recognition such as include image recognition, character recognition, visual recognition, facial recognition, color recognition, shape recognition and the like. Advantageously, the intelligent imager **201** can recognize whether a user's face or eyes are oriented toward the display (**102**) or another major surface of the electronic device (**100**), whether a user is gazing toward the display (**102**) or another major surface of the electronic device (**100**), or spatially where a user's eyes or face are located in three-dimensional space relative to the electronic device (**100**).

In addition to capturing photographs, the intelligent imager **201** can function in other ways as well. For example, in some embodiments the intelligent imager **201** can capture multiple successive pictures to capture more information that can be used to determine bearing and/or location. By referencing video or successive photographs with reference data, the intelligent imager **201** can determine, for example, whether a shield to which the electronic device (**100**) is coupled is in a first position or a second position that is radially displaced about headwear from the first position and the like. Alternatively, the intelligent imager **201** can capture images or video frames, with accompanying metadata such as motion vectors. This additional information captured by the intelligent imager **201** can be used to detect bearing and/or location of shields when coupled to the same.

In one embodiment, the sensor circuits **113** can include one or more proximity sensors. The proximity sensors can include one or more proximity sensor components **202**. The proximity sensor components **202** can also include one or more proximity detector components **203**. In one embodiment, the proximity sensor components **202** comprise only signal receivers. By contrast, the proximity detector components **203** include a signal receiver and a corresponding signal transmitter.

While each proximity detector component **203** can be any one of various types of proximity sensors, such as but not limited to, capacitive, magnetic, inductive, optical/photoelectric, imager, laser, acoustic/sonic, radar-based, Doppler-based, thermal, and radiation-based proximity sensors, in one or more embodiments the proximity detector components **203** comprise infrared transmitters and receivers. The infrared transmitters are configured, in one embodiment, to transmit infrared signals having wavelengths of about 860 nanometers, which is one to two orders of magnitude shorter than the wavelengths received by the proximity sensor components **202**. The proximity detector components **203** can have signal receivers that receive similar wavelengths, i.e., about 860 nanometers.

In one or more embodiments the proximity sensor components **202** have a longer detection range than do the proximity detector components **203** due to the fact that the proximity sensor components **202** detect heat directly emanating from a person's body (as opposed to reflecting off the person's body) while the proximity detector components **203** rely upon reflections of infrared light emitted from the signal transmitter. For example, the proximity sensor component **202** may be able to detect a person's body heat from a distance of about ten feet, while the signal receiver of the proximity detector component **203** may only be able to detect reflected signals from the transmitter at a distance of about one to two feet.

In one embodiment, the proximity sensor components **202** comprise an infrared signal receiver so as to be able to detect infrared emissions from a person. Accordingly, the proximity sensor components **202** require no transmitter since objects disposed external to the housing (**101**) of the electronic device (**100**) deliver emissions that are received by the infrared receiver. As no transmitter is required, each proximity sensor component **202** can operate at a very low power level. Evaluations show that a group of infrared signal receivers can operate with a total current drain of just a few microamps (~10 microamps per sensor). By contrast, a proximity detector component **203**, which includes a signal transmitter, may draw hundreds of microamps to a few milliamps.

In one embodiment, one or more proximity detector components **203** can each include a signal receiver and a corresponding signal transmitter. The signal transmitter can transmit a beam of infrared light that reflects from a nearby object and is received by a corresponding signal receiver. The proximity detector components **203** can be used, for example, to compute the distance to any nearby object from characteristics associated with the reflected signals. The reflected signals are detected by the corresponding signal receiver, which may be an infrared photodiode used to detect reflected light emitting diode (LED) light, respond to modulated infrared signals, and/or perform triangulation of received infrared signals.

Another possible sensor circuit **113** is a near field communication circuit **204**. The near field communication circuit **204** can be included for communication with other electronic devices, local area networks, and so forth to receive information relating to physical configurations of headwear to which the electronic device (**100**) may be coupled. Illustrating by example, the near field communication circuit **204** may poll other communication circuits embedded in headwear to determine the position of one or more shields of the headwear. Examples of suitable near field communication circuits include Bluetooth communication circuits, IEEE 801.11 communication circuits, infrared communication circuits, magnetic field modulation circuits, and Wi-Fi circuits.

The sensor circuits **113** can also include motion detectors, such as one or more accelerometers **205**, and/or gyroscopes **206**. For example, an accelerometer **205** may be used to show vertical orientation, constant tilt and/or whether the electronic device (**100**) is stationary. The measurement of tilt relative to gravity is referred to as "static acceleration," while the measurement of motion and/or vibration is referred to as "dynamic acceleration." A gyroscope **206** can be used in a similar fashion.

The motion detectors can also be used to determine the spatial orientation of the electronic device (**100**) as well in three-dimensional space by detecting a gravitational direction. This can determine, for example, whether the display (**102**) of the electronic device (**100**) is pointing downward to the earth or laterally to a user's eyes. In addition to, or instead of, an accelerometer **205** and/or gyroscope **206**, an electronic compass can be included to detect the spatial orientation of the electronic device (**100**) relative to the earth's magnetic field. Similarly, the gyroscope **206** can be included to detect rotational motion of the electronic device (**100**).

A light sensor **207** can detect changes in optical intensity, color, light, or shadow in the environment of an electronic device (**100**). This can be used to make inferences about whether a first shield of headwear is in a first position or in a second, radially displaced position by determining whether ambient light is being received. For example, if the light sensor **207** detects low-light conditions due to the fact that the first shield, which may be opaque, is in a first position, the one or more processors (**104**) can cause the electronic device (**100**) to operate in a virtual reality mode of operation. Said differently, when the first shield is in the first position, in in one or more embodiments the light sensor **207** will detect an absence of ambient light. The one or more processors (**104**) may then cause the electronic device (**100**) to operate in the virtual reality mode of operation. An infrared sensor can be used in conjunction with, or in place of, the light sensor **207**. The infrared sensor can be configured to detect thermal emissions from an environment about an electronic device, such as when sunlight is incident upon the electronic device.

A magnetometer **208** can be included as well. The magnetometer **208** can be configured to detect the presence of external magnetic fields. Illustrating by example, the magnetometer **208** can be used to determine whether a first shield is in a first position or a radially displaced second position by determining whether a magnet or metal material disposed along the second shield is adjacent to the first shield or not. As the first shield is moved relative to the second shield, the magnetometer **208** can be operable to detect different materials. This information can be used by the one or more processors (**104**) to determine whether to operate the electronic device (**100**) in a normal mode of operation, a virtual reality mode of operation, or an augmented reality mode of operation, as will be described in more detail below with reference to subsequent figures.

The sensor circuits **113** can also include an audio capture device **209**, such as one or more microphones to receive acoustic input. The one or more microphones can be used to sense voice input, voice commands, and other audio input. The one or more microphones include a single microphone. In other embodiments, the one or more microphones can include two or more microphones. Where multiple microphones are included, they can be used for selective beam steering to, for instance, determine from which direction a sound emanated. Illustrating by example, a first microphone can be located on a first side of the electronic device (**100**) for receiving audio input from a first direction, while a second microphone can be placed on a second side of the electronic device (**100**) for receiving audio input from a second direction. The one or more processors (**104**) can then select between the first microphone and the second microphone to determine where the user is located in three-dimensional space relative to the electronic device (**100**).

It should be noted that the illustrative sensor circuits **113** of FIG. **2** are not comprehensive. Numerous others could be added. Accordingly, the sensor circuits **113** of FIG. **2** are illustrative only, as numerous others will be obvious to those of ordinary skill in the art having the benefit of this disclosure.

Turning now to FIG. **3**, illustrated therein is one explanatory apparatus **300** configured in accordance with one or more embodiments of the disclosure. The illustrative apparatus **300** of FIG. **3** is configured as headwear that can be worn by a user, and is shown in exploded view.

In this illustrative embodiment, the apparatus **300** includes a head receiver **301**. The head receiver **301** is to receive a user's head. When the user desires to don the apparatus **300**, they place their head into the head receiver **301**. The head receiver **301** can be adjustable to accommodate different sizes of heads. While the head receiver **301** is shown illustratively as a headband, it can take other forms as well, including structural shapes such as a cap, hat, helmet, or other head-covering device.

The apparatus **300** also includes a first shield **302** and a second shield **303**. In one embodiment, the first shield **302** is manufactured from an opaque material, such as an opaque thermoplastic material. In one embodiment, the second shield **303** is manufactured from a pellucid or translucent material so that ambient light can pass through. For instance, the second shield **303** can be manufactured from a clear thermoplastic material.

In one embodiment, the first shield **302** is pivotally coupled to the head receiver **301** so as to be movable between a first position relative to the head receiver **301** and a second position that is angularly displaced about the head receiver **301** relative to the first position. In one embodiment, the second shield **303** is also pivotally coupled to the head receiver **301** so as to be movable between a first position relative to the head receiver **301** and a second position that is angularly displaced about the head receiver **301** relative to the first position. In other embodiments, the second shield **303** is fixedly coupled to the head receiver **301** so as not to be movable.

In this illustrative embodiment, each of the first shield **302** and the second shield **303** is coupled to the head receiver **301** by way of a track **304**. In subsequent embodiments, as will be described with reference to FIGS. **7-8** below, the first shield **302** and the second shield **303** can be coupled directly to the head receiver **301**. Other configurations and coupling schemes will be obvious to those of ordinary skill in the art having the benefit of this disclosure.

In this illustrative embodiment, the first shield **302** is coupled to an interior **305** of the track **304**, while the second shield **303** is coupled to an exterior **306** of the track **304**. When transitioning between the first position and the second, angularly displaced position relative to the head receiver **301**, in one embodiment the first shield **302** can travel along the interior **305** of the track **304** to ensure a consistent motion. Where the second shield **303** is movable relative to the head receiver **301**, in one embodiment the second shield **303** can travel along the exterior **306** of the track **304**. In other embodiments, the second shield **303** will be fixedly coupled to the exterior **306** of the track **304**. In either scenario, the second shield **303** is coupled to the head receiver **301** exterior to the first shield **302**. Thus, when the first shield **302** moves relative to the second shield **303**, the exterior surface of the first shield **302** passes along an interior surface of the second shield **303**. One or more mechanical features can be added to the interior **305** or exterior **306** of the track **304** to retain the first shield **302** and/or second shield **303** to the track **304** as desired.

In one or more embodiments, each of the first shield **302** and the second shield **303** is pivotally coupled to the track **304** by way of one or more couplers **311**,**312**,**313**,**314**. For example, in one embodiment the two couplers **311**,**312** couple the first shield **302** to the interior **205** of the track **304**, while two other couplers **313**,**314** couple the second shield **303** to the exterior **306** of the track **304**.

The couplers **311**,**312**,**313**,**314** can be any of a number of different mechanisms that allow one or both of the first shield **302** or the second shield **303** to be flipped, rotated, detached, attached, or otherwise moved. For example, in one embodiment the couplers **311**,**312**,**313**,**314** comprise pin-and-barrel hinges. In another embodiment, the couplers **311**,**312**,**313**,**314** comprises hinge or pivoting devices. In one or more embodiments, the couplers **311**,**312**,**313**,**314** comprise torsion springs to bias one or both of the first shield **302** or the second shield **303** toward the first position or the angularly displaced second position. The torsion springs can also help to facilitate movement between the first position and the angularly displaced second position. Moreover, in some embodiments the torsion springs can preload one or both of the first shield **302** or the second shield **303** in the second, angularly displaced position. Other examples of couplers **311**,**312**,**313**,**314** will be obvious to those of ordinary skill in the art having the benefit of this disclosure.

In one embodiment, the second shield **303** comprises a holographic optical element **307**. In one or more embodiments, the holographic optical element **307** is translucent such that ambient light can pass therethrough. The holographic optical element **307** can be any of a lens, filter, beam splitter, diffraction grating, or other device capable of reflecting light received along the interior of the second shield **303** to create holographic images. In one illustrative embodiment, the holographic optical element **307** comprises a pellucid holographic lens that is either integral to, or coupled to, the second shield **303**. Other examples of holographic optical elements will be obvious to those of ordinary skill in the art having the benefit of this disclosure.

In one or more embodiments, the first shield **302** includes an electronic device receiver **308**. Where the apparatus **300** is to be used with a portable electronic device (**100**), the electronic device receiver **308** is configured to receive the electronic device (**100**) and retain it in a securely coupled configuration with the first shield **302**. As noted above, in other embodiments the components of the electronic device (**100**) can be integrated into the apparatus **300**. Accordingly, in such embodiments, the electronic device receiver **308** can be replaced by a display and corresponding electronics, or alternatively a pair of displays, e.g., a left display and a right display. The display can optionally include a projector as previously described. Where a single display is used, it can of course present multiple images to the user at the same time (one for each eye). To provide a virtual reality experience, different information or content can be delivered to each of the user's eyes.

In one or more embodiments, the first shield **302** also includes one or more optical lenses **309**,**310**. Since the electronic device (**100**), when positioned in the electronic device receiver **308**, can be too close to the user's eyes for the user to properly focus upon the images, in one or more embodiments, the one or more optical lenses **309**,**310** can bend the light to make it easier for the user's eyes to see. Additionally, where multiple images are presented to the user at the same time, the one or more optical lenses **309**,**310** can help segregate this content so that the proper content reaches the proper eye without interference from content intended for the other eye. In one embodiment, the one or more optical lenses **309**,**310** comprise Fresnel lenses. In another embodiment, the one or more optical lenses **309**,**310** comprise hybrid Fresnel lenses. Other types of lenses will be obvious to those of ordinary skill in the art having the benefit of this disclosure.

In this illustrative embodiment, the optical lenses **309**,**310** are pivotally coupled to the first shield **302** so as to be pivotable between a first position relative to the first shield **302** and a second, angularly displaced position relative to the first shield **302**. Embodiments of the disclosure contemplate that the user will need to look at the display (**102**) of the electronic device (**100**) through the one or more optical lenses **309**,**310** when the apparatus **300** is functioning as a virtual reality headset and the first shield **302** is in the first position. However, the one or more optical lenses **309**,**310** are not needed when the apparatus **300** is functioning as an augmented reality device. Additionally, the one or more optical lenses **309**,**310** can cause optical interference between the display (**102**) or projector (**107**) of the electronic device (**100**) and the holographic optical element **307** off which images reflect to provide augmented reality imagery to the user. Advantageously, the inclusion of one or more couplers **315**,**316** to pivotally couple the one or more optical lenses **309**,**310** to the first shield **302** allows them to pivot, when the first shield **302** is in the second, angularly displaced position relative to the head receiver **301**, so as to define an unobstructed optical line of sight between the electronic device receiver and the holographic optical element. This will be illustrated in more detail below with reference to FIG. **5**.

In one or more embodiments, an optional visor **317** can be coupled to the track **304** or the first shield **302** to prevent ambient light from passing to the eyes of a user. Where the visor **317** is included, it works to ensure that the minimum quantity of exterior light reaches the user's eyes when the apparatus **300** is operating as a virtual reality headset. The visor **317** can also work to improve the user experience by reducing noise introduced by ambient light interfering with the images presented by the display (**102**) of the electronic device (**100**). Moreover, the display (**102**) can operate at a lower brightness, thereby conserving power when the visor **317** is in place. The visor **317** can optionally be detachable such that it is only attached to the first shield **302** when the apparatus **300** is operating as a virtual reality headset.

The apparatus **300** can optionally include integrated electronics **318** as well. For example, in one or more embodiments, the apparatus **300** is configured as an electronic device. Accordingly, the head receiver **301** or another part of the apparatus can comprise one or more electrical components. Some of these electrical components are shown illustratively in FIG. **3**. It will be clear to those of ordinary skill in the art having the benefit of this disclosure that the electrical components and associated modules can be used in different combinations, with some components and modules included and others omitted. Components or modules can be included or excluded based upon need or application.

The electronic components can include one or more processors **319**. The one or more processors **319** can be operable with a memory **320**. The one or more processors **319**, which may be any of one or more microprocessors, programmable logic, application specific integrated circuit device, or other similar device, are capable of executing program instructions and methods. The program instructions and methods may be stored either on-board in the one or more processors **319**, or in the memory **320**, or in other computer readable media coupled to the one or more processors **319**.

In one or more embodiments, the apparatus **300** also includes an optional wireless communication device **321**. Where included, the wireless communication device **321** is operable with the one or more processors **319**, and is used to facilitate electronic communication with one or more electronic devices or servers or other communication devices across a network. Note that it is possible to combine the one or more processors **319**, the memory **320**, and the wireless communication device **321** into a single device, or alternatively into devices having fewer parts while retaining the functionality of the constituent parts.

A battery **322** or other energy storage device can be included to provide power for the various components of the apparatus **300**. While a battery **322** is shown in FIG. **2**, it will be obvious to those of ordinary skill in the art having the benefit of this disclosure that other energy storage devices can be used instead of the battery **322**, including a micro fuel cell or an electrochemical capacitor. The battery **322** can include a lithium ion cell or a nickel metal hydride cell, such cells having sufficient energy capacity, wide operating temperature range, large number of charging cycles, and long useful life. The battery **322** may also include overvoltage and overcurrent protection and charging circuitry. In one embodiment, the battery **322** comprises a small, lithium polymer cell.

In one or more embodiments, a photovoltaic device **323**, such as a solar cell, can be included to recharge the battery **322**. In one embodiment, the photovoltaic device **323** can be disposed along the head receiver **301**, or optionally on the visor **317**.

Other components **324** can be optionally included in the apparatus **300** as well. For example, in one embodiment one or more microphones can be included as audio capture devices **325**. These audio capture devices can be operable with the one or more processors **319** to receive voice input. Additionally, in one or more embodiments the audio capture device **325** can capture ambient audio noise and cancel it out. In one or more embodiments, the audio capture device **325** can record audio to the memory **320** for transmission through the wireless communication device **321** to a server complex across a network.

The other components **324** can also include a motion generation device **326** for providing haptic notifications or vibration notifications to a user. For example, a piezoelectric transducer, rotational motor, or other electromechanical device can be configured to impart a force or vibration upon the head receiver **301**. The motion generation device **326** can provide a thump, bump, vibration, or other physical sensation to the user. The one or more processors **319** can be configured to actuate the motion generation device **326** to deliver a tactile or vibration output alone or in combination with other outputs such as audible outputs.

Similarly, in one or more embodiments the eyewear can include a video capture device **327** such as an imager. In one or more embodiments, the video capture device **327** can function as a to detect changes in optical intensity, color, light, or shadow in the near vicinity of the apparatus **300**. Other optional components include a global positioning system device **328** for determining where the apparatus **300** is located. The global positioning system device **328** can communicate with a constellation of earth orbiting satellites or a network of terrestrial base stations to determine an approximate location. Examples of satellite positioning systems suitable for use with embodiments of the present invention include, among others, the Navigation System with Time and Range (NAVSTAR) Global Positioning Systems (GPS) in the United States of America, the Global Orbiting Navigation System (GLONASS) in Russia, and other similar satellite positioning systems. While a global positioning system device **328** is one example of a location determination module, it will be clear to those of ordinary skill in the art having the benefit of this disclosure that other location determination devices, such as electronic compasses or gyroscopes, could be used as well.

An optional user interface **329** can be included. The user interface **329** can be used, for example, to activate the circuit components or turn them OFF and so forth. The user interface **329**, where included, can be operable with the one or more processors **319** to deliver information to, and receive information from, a user. The user interface **329** can include a rocker switches, slider pad, button, touch-sensitive surface, or other controls, and optionally a voice command interface. These various components can be integrated together.

In one or more embodiments, an audio output device **230**, such as a loudspeaker or other transducer, can deliver audio output to a user. For example, piezoelectric transducers can be operably disposed within the head receiver. Actuation of the piezoelectric transducers can cause the same to vibrate, thereby emitting acoustic output. More traditional audio output devices **230**, such as loudspeakers, can be used as well.

A haptic device **331** can be included for providing haptic feedback to a user. The haptic device **331** can include a motion generation device to deliver a tactile response to the user. For example, a piezoelectric transducer or other electromechanical device can be included in the head receiver **301**. The transducer can actuate to impart a force upon the user's head to provide a thump, bump, vibration, or other physical sensation to the user. The inclusion of both the audio output device **330** and the haptic device **331** allows both audible and tactile feedback to be delivered to the user to enhance either a virtual reality experience or an augmented reality experience.

The apparatus **300** of FIG. **3** can operate as a stand-alone electronic device in one or more embodiments, such as when it includes a display and other corresponding electronic components as noted above. However, in other embodiments, the apparatus **300** can operate in tandem with a portable electronic device, such as the electronic device (**100**) from FIG. **1**, to form a combined headwear/eyewear system.

In one or more embodiments, the electronic device receiver **308** is electrically coupled to one or more of the integrated electronics **318**. For example, in one embedment the electronic device receiver **308** includes a connector **332** that is coupled by an electrical connector **333** to one or more of the integrated electronics **318**. In the illustrative embodiment of FIG. **3**, the connector **332** is electrically coupled to one or more positional detectors **334** operable with the couplers **311**,**312** of the first shield **302** to determine whether the first shield **302** is in the first position or the second, angularly displaced position. In one embodiment, the couplers **311**,**312** comprise the positional detectors **334**. Where such positional detectors **334** are included, the electrical connector **333** can be coupled directly to the positional detectors **334**, or optionally to the one or more processors **319**, to receive an electronic signal **335** indicating whether the first shield **302** is in the first position, the second, angularly displaced position, or somewhere in between.

Now that the various hardware components have been described, attention will be turned to methods, systems, and use cases in accordance with one or more embodiments of the disclosure. Turning now to FIG. **4**, a user **400** is shown wearing the apparatus **300** of FIG. **3**. The user **400** has inserted his head **401** into the head receiver **301**.

In this illustrative embodiment, both the first shield **302** and the second shield **303** are pivotable relative to the track **304**. As shown in FIG. **4**, each of the first shield **302** and the second shield **303** have been rotated to a second, angularly displaced position **402** relative to the head receiver **301**. Advantageously, the user **400** can see the world around themself without optical interference from either the first shield **302** or the second shield **303**.

As shown in FIG. **4**, in one embodiment when the first shield **302** is pivoted about the track **304** to the second, angularly displaced position, the one or more optical lenses **309**,**310** pivot to a second orientation **403** about their couplers **315**,**316**. In this illustrative embodiment, the one or more optical lenses **309**,**310** are pulled downward by the action of gravity about the couplers **315**,**316**.

Turning now to FIG. **5**, the second shield **303** has been pivoted about the track **304** from the second, angularly displaced position **402** to a first position **502**. The first shield **302** is still in the second, angularly displaced position **402**. The one or more optical lenses **309**,**310** remain pivoted to the second orientation **403** about their couplers **315**,**316**. This defines an unobstructed optical line of sight **501** between the electronic device receiver **308** and the holographic optical element **307** of the second shield **303**. Accordingly, either the display (**102**) or projector (**107**) of an electronic device (**100**), or alternatively an integrated display or imager, can reflect light off the holographic optical element **307** to provide an augmented reality experience **500** to the user **400**. Since the second shield **303** is pellucid or translucent in one or more embodiments, the augmented reality experience **500** allows the user **400** to see images superimposed on the view of their environment.

Turning now to FIG. **6**, the first shield **302** has been pivoted from the second, angularly displaced position (**402**) to the first position **502**. The one or more optical lenses **309**,**310**, due to the operation of gravity in this embodiment (a motor or other mechanism could also be used) pivot from the second orientation (**403**) to a first orientation **603**. In the first orientation **603**, the optical line of sight **601** between the electronic device receiver **308** and the user **400** passed through the one or more optical lenses **309**,**310**. Accordingly, either the display (**102**) or projector (**107**) of an electronic device (**100**), or alternatively an integrated display or imager, can deliver light through the one or more optical lenses **309**,**310** to provide a virtual reality experience **600** to the user **400**. Since the first shield **302** is opaque in one or more embodiments, the user **400** experiences the virtual reality experience **600** without the interference of ambient light. A visor (**317**) can be added to further block ambient light in one or more embodiments.

Turning now to FIG. **7**, illustrated therein is a user **400** wearing an alternate apparatus **700** configured in accordance with one or more embodiments of the disclosure. In this embodiment, the apparatus comprises headwear **701** comprising a head receiver **702**. A first shield **703** and a second shield **704** are pivotally coupled to the head receiver **702**. In this embodiment, the second shield **704** is coupled exterior to the first shield **703** relative to the face of the user **400**. As before, the second shield **704** comprises a holographic optical element **705**.

An electronic device **100** is mechanically coupled to the first shield **703** by way of an electronic device receiver. In one embodiment, the electronic device **100** comprises one or more processors (**104**) operable to determine whether the first shield **703** is in a first position relative to the head receiver **702**, as shown in FIG. **7**, or is in a second, angularly displaced position, as shown in FIG. **8**.

In FIG. **7**, the first shield **703** is in the first position. Where this is the case, the one or more processors (**104**) operate the electronic device **100** in a virtual realty mode of operation **706**. Here, in the virtual reality mode of operation **706**, the display (**102**) or projector (**107**) of the electronic device **100** delivers light through the one or more optical lenses **707** to provide virtual reality images **708** to the user **400**. In this illustrative embodiment, thereto, the one or more processors (**104**) operate the electronic device **100** in the virtual reality mode of operation **706** by delivering one or more virtual reality images **708** to the one or more optical lenses **707**. Since the first shield **703** is opaque in one or more embodiments, the user **400** experiences the virtual reality images **708**, shown as floating stars for illustration, without the interference of ambient light. A visor (not shown) can be added to further block ambient light in one or more embodiments.

By contrast, turning now to FIG. **8**, the first shield **703** has been pivoted about the headwear **701** to the second, angularly displaced position. In one embodiment, when this occurs, one or more optical lenses **707**, pivotally coupled to the first shield **703**, pivot from a first orientation relative to the first shield **703**, shown in FIG. **7**, to a second orientation relative to the first shield **703**, shown in FIG. **8**. This defines an unobstructed optical line of sight **801** between one or more of the electronic device **100**, the display (**102**) of the electronic device **100**, and/or the projector (**107**) of the electronic device **100** and the holographic optical element **705** of the second shield **704**. Where the first shield **703** is in the second, angularly displaced position, in one or more embodiments the one or more processors (**104**) operate the electronic device **100** in an augmented reality mode of operation **806**. For example, where the electronic device **100** includes a projector (**107**), the one or more processors (**104**) can operate the electronic device **100** in the augmented reality mode of operation **806** by delivering one or more images **808**, here pictures of the user's dog, Buster, to the holographic optical element **705** of the second shield **704** for reflection to the user's eyes.

Turning now to FIG. **9**, illustrated therein is one explanatory method **900** in accordance with one or more embodiments of the disclosure. At decision **901**, the method **900**, with one or more processors of an electronic device, whether the electronic device is coupled to a first shield of headwear comprising a head receiver. Where it is not, the one or more processors operate the electronic device normally at step **902**.

Where the electronic device is coupled to a first shield of headwear comprising a head receiver, at decision **903** the one or more processors determine whether the first shield of the headwear is in a second, angularly displaced position relative to the head receiver. Where it is, at step **904** the one or more processors operate the electronic device in an augmented reality mode of operation.

At decision **905** the one or more processors determine whether the first shield of the headwear is in a first position relative to the head receiver. Where it is, at step **906** the one or more processors operate the electronic device in an augmented reality mode of operation. In one embodiment, step **906** comprises projecting, with a projector of the electronic device, one or more images to a holographic optical element of a second shield of the headwear.

Decision **903** and decision **905** can be made in various ways as a function of various inputs. Turning now to FIG. **10**, some examples of these techniques and those inputs are shown. These are examples only. Other techniques and other inputs will be obvious to those of ordinary skill in the art having the benefit of this disclosure.

Beginning with step **1001**, in one embodiment the headwear comprises positional detectors to determine whether the first shield is in the first position or the second, angularly displaced position. Accordingly, in one embodiment, decision **903** and decision **905** comprise receiving, at step **1001**, from a positional detector of the headwear, a signal indicating whether the first shield is in the first position or the second, angularly displaced position.

At step **1002**, in one embodiment the electronic device comprises an intelligent imager. Accordingly, in one embodiment, decision **903** and decision **905** comprise, at step **1002**, using the intelligent imager to determine whether the first shield is in a first position relative to the head receiver or a second, angularly displaced position by capturing images of a user's eyes with the intelligent imager.

Alternatively, as shown at step **1005**, an image captured by the intelligent imager can be compared to a reference image to determine, for example, whether the user's face appears in the image. If, for example, the user's face fails to appear in the image, this can mean that the display is facing downward and that the first shield is in the second, angularly displaced position. By contrast, where the user's face appears in the image, this can mean the display is facing laterally and the shield is in the first position.

At step **1003**, in one embodiment the electronic device comprises a gravity detector. For example, as one or more accelerometers and/or gyroscopes may be used to show vertical orientation, constant, or a measurement of tilt relative to gravity. Accordingly, in one embodiment, decision **903** and decision **905** comprise, at step **1003**, using the gravity detector to determine whether the first shield is in a first position relative to the head receiver or a second, angularly displaced position by detecting a gravitational direction. If, for example, the direction of gravity is through a major face of the electronic device, such as the display, this can mean that the display is facing downward and that the first shield is in the second, angularly displaced position. By contrast, where the direction of gravity runs through a minor face of the electronic device, e.g., a side of the electronic device, this can mean the display is facing laterally and the shield is in the first position.

At step **1004**, in one embodiment the electronic device comprises one or more proximity sensors. Accordingly, in one embodiment, decision **903** and decision **905** comprise, at step **1004**, determining whether the first shield is in a first position relative to the head receiver or a second, angularly displaced position by determining whether an object is proximately located with the display. If an object such as the user's face is closer to the display, as determined by the proximity sensors, the first shield is likely in the first position. By contrast, if the object is farther from the display, as determined by the proximity sensors, the first shield is likely in the second, angularly displaced position.

At step **1006**, in one embodiment the electronic device comprises a magnetometer. In one embodiment, the second shield includes a magnet or magnetic material. Accordingly, in one embodiment, decision **903** and decision **905** comprise, at step **1006**, determining whether the first shield is in a first position relative to the head receiver or a second, angularly displaced position by determining whether the magnetometer detects a stronger or weaker magnetic field. If a stronger magnetic field is detected, as determined by the magnetometer, the first shield is likely in the first position. By contrast, if a weaker or no magnetic field is detected, as determined by the magnetometer, the first shield is likely in the second, angularly displaced position.

The various techniques and inputs of FIG. **10** can be used in a variety of ways. Illustrating by example, in one embodiment, the electronic device is inserted into an electronic device receiver of the first shield. The electronic device receiver has an electronic connector, which in one embodiment is a Universal Serial Bus (USB) **3** connector. Alternatively, the electronic connector can be a USB-C connector or other interface. In still other embodiments, the electronic connector can be a USB-SS connector, a Serial Peripheral Interface (SPI) connector, a Display Serial Interface (DSI) connector, a Camera Serial Interface (CSI) connector, a Mobile Industry Processor Interface (MIPI) connector, or other type of connector. Still other connectors will be obvious to those of ordinary skill in the art. Working in conjunction with positional detectors disposed within the headwear, electronic signals can be received through the electrical connector to inform the device whether the first shield is in the first position or the second, angularly displaced position.

Alternatively, using an intelligent imager, the electronic device can determine if the user's eyes are detected. If the users eyes are detected, the one or more processors operate in a virtual reality mode of operation. By contrast, where the eyes are not detected, the one or more processors can operate in an augmented reality mode of operation.

Alternatively, since an intelligent imager may consume relatively high amounts of current, one or more proximity sensors can be used in conjunction with the intelligent imager to conserve power. Specifically, the one or more proximity sensors can detect the positioning of the electronic device in the headwear before actuating the intelligent imager to confirm the same information. When the first shield is in the second, angularly displaced position, the one or more proximity sensors will not detect a close presence of the user. The intelligent imager can confirm this first shield position by confirming that the user's eyes are not detected.

By contrast, when the first shield is in the first position, the one or more proximity detectors will detect a close presence of the user. The intelligent imager can confirm this first shield position by capturing images of the user's eyes.

In still another embodiment, the intelligent imager can employ a reference picture or icon such that when the first shield is in the second, angularly displaced position the reference picture or icon will not be detected. However, when the first shield is in the first position, the intelligent imager will detect the reference picture or icon.

In still another embodiment, an accelerometer, gravity detector, or gyroscope can determine the position of the first shield. The one or more processors can monitor the accelerometer to detect, for example, a gravitational direction.

Each first shield position would have associated therewith reference accelerometer sensor data. This could be referenced to determine whether the first shield is in the first position or the second, angularly displaced position. The examples above are illustrative only, as numerous others will be obvious to those of ordinary skill in the art having the benefit of this disclosure.

In the foregoing specification, specific embodiments of the present disclosure have been described. However, one of ordinary skill in the art appreciates that various modifications and changes can be made without departing from the scope of the present disclosure as set forth in the claims below. Thus, while preferred embodiments of the disclosure have been illustrated and described, it is clear that the disclosure is not so limited. Numerous modifications, changes, variations, substitutions, and equivalents will occur to those skilled in the art without departing from the spirit and scope of the present disclosure as defined by the following claims. Accordingly, the specification and figures are to be regarded in an illustrative rather than a restrictive sense, and all such modifications are intended to be included within the scope of present disclosure. The benefits, advantages, solutions to problems, and any element(s) that may cause any benefit, advantage, or solution to occur or become more pronounced are not to be construed as a critical, required, or essential features or elements of any or all the claims.

What is claimed is:

1. An apparatus, comprising:

a head receiver;

a first shield, pivotally coupled to the head receiver and movable between a first position relative to the head receiver and a second, angularly displaced position relative to the head receiver, the first shield comprising:

an electronic device receiver; and

one or more optical lenses pivotally coupled to the first shield; and

a second shield, coupled to the head receiver exterior to the first shield, the second shield comprising a holographic optical element.

2. The apparatus of claim **1**, the first shield manufactured from an opaque material.

3. The apparatus of claim **2**, the second shield manufactured from a pellucid material.

4. The apparatus of claim **2**, the holographic optical element comprising a pellucid holographic lens.

5. The apparatus of claim **1**, the apparatus further comprising a positional detector and one or more processors detecting, with the positional detector, whether the first shield is in the first position or the second, angularly displaced position.

6. The apparatus of claim **5**, the electronic device receiver further comprising a connector electrically coupled to the one or more processors, the one or more processors delivering a signal to the connector indicating whether the first shield is in the first position or the second, angularly displaced position.

7. The apparatus of claim **5**, further comprising one or more couplers pivotally coupling the first shield to the head receiver, wherein the one or more couplers comprise the positional detector.

8. The apparatus of claim **1**, wherein the one or more optical lenses pivot from a first orientation to a second orientation when the first shield pivots from the first position to the second, angularly displaced position to define an unobstructed optical line of sight between the electronic device receiver and the holographic optical element.

9. An apparatus, comprising:

headwear comprising a head receiver comprising a first shield pivotally coupled to the head receiver and a second shield coupled to the head receiver exterior to the first shield, wherein the second shield comprises a holographic optical element; and

an electronic device mechanically coupled to the first shield, the electronic device comprising one or more processors:

determining whether the first shield is in a first position relative to the head receiver or a second, angularly displaced position; and

where the first shield is in the first position, operating the electronic device in a virtual reality mode of operation; and

where the first shield is in the second, angularly displaced position, operating the electronic device in an augmented reality mode of operation.

10. The apparatus of claim **9**, the electronic device comprising a projector, wherein the one or more processors operate the electronic device in the augmented reality mode of operation by delivering one or more images to the holographic element.

11. The apparatus of claim **10**, the first shield comprising one or more optical lenses pivotally coupled thereto, the one or more optical lenses pivoting from a first orientation relative to the first shield to a second orientation relative to the first shield when the first shield pivots from the first position to the second, angularly displaced position to define an unobstructed optical line of sight between the projector and the holographic optical element.

12. The apparatus of claim **9**, the first shield comprising one or more optical lenses pivotally coupled thereto, wherein the one or more processors operate the electronic device in the virtual reality mode of operation by delivering one or more images to the one or more optical lenses.

13. The apparatus of claim **9**, the electronic device comprising a gravity detector, the one or more processors determining whether the first shield is in a first position relative to the head receiver or a second, angularly displaced position by detecting a gravitational direction.

14. The apparatus of claim **9**, the electronic device comprising an intelligent imager, the one or more processors determining whether the first shield is in a first position relative to the head receiver or a second, angularly displaced position by capturing images of a user's eyes with the intelligent imager.

15. The apparatus of claim **9**, the electronic device comprising a display one or more proximity sensors, the one or more processors determining whether the first shield is in a first position relative to the head receiver or a second, angularly displaced position by determining whether an object is proximately located with the display.

16. The apparatus of claim **9**, the headwear further comprising a positional detector, the one or more processors determining whether the first shield is in a first position relative to the head receiver or a second, angularly displaced position by receiving, through a connector coupled to the first shield, a signal indicating whether the first shield is in the first position or the second, angularly displaced position.

17. A method, comprising:

determining, with one or more processors of an electronic device, whether the electronic device is coupled to a first shield of headwear comprising a head receiver;

detecting, with the one or more processors, whether the first shield of the headwear is in a first position relative to the head receiver or in a second, angularly displaced position relative to the head receiver; and

where the first shield is in the first position, operating, with the one or more processors, the electronic device in a virtual reality mode of operation; and

where the first shield is in the second, angularly displaced position, operating, with the one or more processors, the electronic device in an augmented reality mode of operation.

18. The method of claim **17**, wherein operating the electronic device in the augmented reality mode of operation comprises projecting, with a projector of the electronic device, one or more images to a holographic optical element of a second shield of the headwear.

19. The method of claim **17**, the detecting comprising receiving, from a positional detector of the headwear, a signal indicating whether the first shield is in the first position or the second, angularly displaced position.

20. The method of claim **17**, the detecting comprising determining, with a gravity detector, a direction of gravity.

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